

**WE CLAIM:**

1. An optical excitation/detection device, comprising:
  2. a CMOS fabricated photodetector array including an arrayed plurality of photoreceptor areas and photoemitter areas, each photoreceptor area including a CMOS integrated photoreceptor, each photoemitter area including at least two buried electric contact pads, the array having a top surface into which is formed at the locations of the photoemitter areas a plurality of regions that reveal the buried electric contact pads; and
    7. a plurality of discrete semiconductor photoemitter devices, each discrete semiconductor photoemitter device being positioned at, aligned with, and mechanically retained by the regions of the CMOS fabricated photodetector array and making electrical contact with the revealed buried electric contact pads therein.
1. 2. The device as in claim 1 wherein the plurality of regions are recessed below the top surface of the array.
1. 3. The device as in claim 1 further including a layer of transparent or translucent material overlying the CMOS fabricated photodetector array and inserted plurality of discrete semiconductor photoemitter devices.
1. 4. The device as in claim 1 wherein the photoreceptors formed in the CMOS fabricated array comprise p-i-n diodes.

1           5.     The device as in claim 1 wherein the photoreceptors formed in the CMOS  
2     fabricated array comprise avalanche photodiodes.

1           6.     The device as in claim 1 wherein the photoreceptors formed in the CMOS  
2     fabricated array comprise charge coupled devices (CCDs).

1           7.     The device as in claim 1 wherein the discrete semiconductor photoemitter  
2     devices comprise light emitting diodes (LEDs).

1           8.     The device as in claim 1 wherein the discrete semiconductor photoemitter  
2     devices comprise discrete laser diodes.

1           9.     The device as in claim 1 wherein the discrete semiconductor photoemitter  
2     devices are mechanically retained at the plurality of regions using an epoxy.

1           10.    The device as in claim 9 wherein the epoxy is conductive to make the  
2     electrical contact between the discrete semiconductor photoemitter device and the revealed  
3     buried electric contact pads.

1           11.    The device as in claim 9 wherein the epoxy absorbs light emitted toward a  
2     substrate of the CMOS fabricated array.

1           12.    A method for assembling an optical excitation/detection device from a CMOS  
2     fabricated photodetector array including an arrayed plurality of photoreceptor areas and

3 photoemitter areas, each photoreceptor area including a CMOS integrated photoreceptor,  
4 each photoemitter area including at least two buried electric contact pads, comprising steps  
5 of:

6 etching back a top surface of the CMOS fabricated photodetector array to form  
7 recessed regions at the locations of the photoemitter areas in order to reveal the buried  
8 electric contact pads; and

9 inserting a plurality of discrete semiconductor photoemitter devices into the  
10 recessed regions of the CMOS fabricated photodetector array to make electrical contact with  
11 the revealed buried electric contact pads therein.

1 13. The method as in claim 12 wherein the step of inserting comprises the step of  
2 performing pick and place assembly to insert the discrete semiconductor photoemitter  
3 devices.

1 14. The method as in claim 12 further including the step of epoxy bonding the  
2 discrete semiconductor photoemitter devices within the recessed regions of the CMOS  
3 fabricated semiconductor array.

1 15. The method as in claim 14 wherein the epoxy is conductive to assist in making  
2 electrical contact between the discrete semiconductor photoemitter devices and the revealed  
3 buried electric contact pads within the recessed regions.

1           16. The method as in claim 12 further including the step of forming a transparent  
2       or translucent layer over the CMOS fabricated semiconductor array and inserted discrete  
3       semiconductor photoemitter devices.

1           17. The method as in claim 12 wherein the discrete semiconductor photoemitter  
2       devices comprise discrete light emitting diodes (LEDs).

1           18. The method as in claim 12 wherein the discrete semiconductor photoemitter  
2       devices comprise discrete laser diodes.

1           19. A method for assembling an optical excitation/detection device from a CMOS  
2       fabricated photodetector array including an arrayed plurality of photoreceptor areas and  
3       photoemitter areas, each photoreceptor area including a CMOS integrated photoreceptor,  
4       each photoemitter area including at least two buried electric contact pads, comprising steps  
5       of:

6               locating photoemitter areas having electrical contact pads;  
7               inserting a plurality of discrete semiconductor photoemitter devices onto the  
8       photoemitter regions of the CMOS fabricated photodetector array to make electrical contact  
9       with the electric contact pads.

1           20. The method of claim 19 further including a step of covering said photoemitter  
2       devices with a transparent or translucent layer.

1           21. The method of claim 19, wherein prior to the step of inserting, a step of placing  
2       photoemitter devices in predetermined transparent or translucent portions of a covering layer  
3       is performed.